

First record of *Eumops perotis* (Schinz, 1821) (Chiroptera, Molossidae) from the Cerrado of Mato Grosso do Sul, Central-West Brazil

Jaire Marinho Torres¹, Grasiela Edith de Oliveira Porfirio², Priscila Ikeda³, Marcelo Oscar Bordignon⁴, Filipe Martins Santos⁵, Carina Elisei^{1,5}

1 Programa de Pós-Graduação em Biotecnologia, Universidade Católica Dom Bosco, Campo Grande, MS, Avenida Tamandaré, 6000, CEP 79117-900, Brazil. **2** Pós-graduação em Recursos Naturais, Universidade Federal de Mato Grosso do Sul, Campo Grande, MS, Cidade Universitária, s/n, CEP 79070-900, Brazil. **3** Programa de Pós-Graduação em Medicina Veterinária, Universidade Estadual Paulista Júlio de Mesquita Filho, Jaboticabal, SP, Via de Acesso Prof. Paulo Donato Castellane, s/n, CEP 14884-900, Brazil. **4** Programa de Pós-Graduação em Biologia Animal, Universidade Federal de Mato Grosso do Sul, Campo Grande, MS, Cidade Universitária, s/n, CEP 79070-900, Brazil. **5** Programa de Pós-Graduação em Ciências Ambientais e Sustentabilidade Agropecuária, Universidade Católica Dom Bosco, Campo Grande, MS, Avenida Tamandaré, 6000, CEP 79117-900, Brazil.

Corresponding author: Jaire Marinho Torres, jairemarinho@gmail.com

Abstract

The Greater Bonneted Bat, *Eumops perotis* (Schinz, 1821), is widely distributed in Brazil, but valid records of its occurrence in Mato Grosso do Sul, Central-West Region, are still scarce and limited to the Pantanal portion of the state. Here, we report the first record of *E. perotis* from the Cerrado portion of Mato Grosso do Sul, based on specimens collected in an urban forest remnant in the municipality of Campo Grande. These specimens add to the records of *E. perotis* in the Cerrado of the Central-West and fill gaps in the distribution of this species.

Keywords

Distribution, Greater Bonneted Bat, South America

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Introduction

The genus *Eumops* Miller, 1906 has a wide distribution occurring from the southern United States to northern Argentina (Eger 2008), and it is considered the most diverse genus of the New World molossid bats (Gregorin et al. 2016). This genus currently comprises 16 species, of which 11 are recorded in Brazil (Nogueira et al. 2018): *E. auripendulus* (Shaw, 1800), *E. bonariensis* (Peters, 1874), *E. chimaera* Gregorin et al., 2016, *E. dabbenei* (Thomas, 1914), *E. delticus* Thomas, 1923, *E. glaucinus*

(Wagner, 1843), *E. hansae* Sanborn, 1932, *E. maurus* (Thomas, 1901), *E. patagonicus* Thomas, 1924, *E. perotis* (Schinz, 1821), and *E. trumbulli* (Thomas, 1901).

Eumops perotis is known from Colombia, Venezuela, Brazil, Ecuador, Peru, Bolivia, Chile, Paraguay, and northern Argentina (Sartore et al. 2017). The species is disjunct in two large populations, with the subspecies *E. perotis californicus* (Merriam, 1890) occurring in the southwestern United States and in northern Mexico,

and subspecies *E. p. perotis* occurring in South America (Eger 2008; Sartore et al. 2017). In Brazil, the species is widely distributed, with records in 14 states, the Federal District, and in all the biomes (Feijó et al. 2010; Suckow et al. 2010; Fischer et al. 2015; Nunes et al. 2017).

The Central-West Region, however, has some of the larger gaps in the knowledge of the distribution of *E. perotis* (Fig. 1), with scarce records from the Cerrado of Federal District (Pacheco et al. 2010) and Goiás (Nunes et al. 2017), and the Pantanal of Mato Grosso (Escarlate-Tavares and Pêsoa 2005) and Mato Grosso do Sul (Fischer et al. 2015). Here, we present the first record of *E. perotis* for the Cerrado portion of Mato Grosso do Sul, Central-West Brazil, based on specimens collected in an urban area of the Campo Grande municipality.

Methods

The specimens were collected during an inventory around the Florestinha Environmental Education Center (FEEC; 20°24'10.90"S, 054°33'42.45"W), Campo Grande, Mato Grosso do Sul. This locality is within an urban area, near housing complexes and is a remnant of

vegetation that includes portions of riparian forest, dry grassland, and savanna swamp. Captures of the specimens were conducted in December 2017, using a mist net of 12.0 × 2.5 m positioned at ground level in the exit of a building.

One external and 10 cranial measurements were taken to four adults individuals with a digital caliper (accurate to 0.01 mm) according to the parameters presented by Gregorin and Taddei (2002) and Reis et al. (2017): forearm length (FA), greatest length of skull (GLS), condyle-incisive length (CIL), palatal length (PAL), zygomatic breadth (ZIB), post-orbital breadth (POB), braincase breadth (BCB), length of upper canine-last molar (C-M), upper molar breadth (M-M), mandible length (MAL), and length of lower canine-last molar (c-m). The taxonomic identification of the collected specimens was based on analysis of the morphological traits and measurements available for the *Eumops* species that occur in Brazil (Anderson 1972; Eger 1977; Best et al. 1996; Gregorin et al. 2016; Sartore et al. 2017).

Furthermore, we conducted a principal component analysis (PCA) with all external and cranial measurements variables from *Eumops* spp. The PCA has the

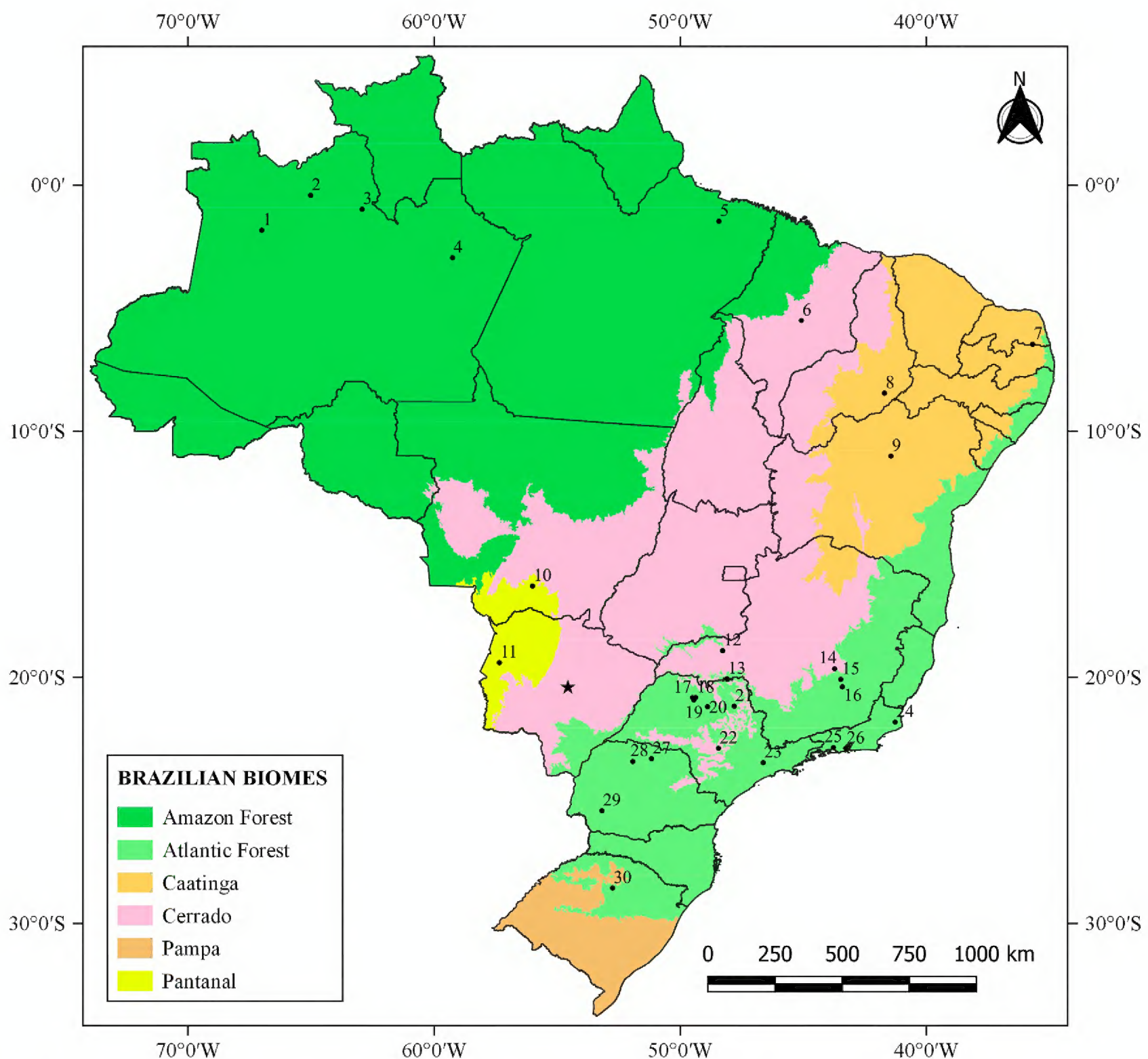


Figure 1. Distribution of *Eumops perotis* in Brazil. Black star: new record from Campo Grande, in the Cerrado of Mato Grosso do Sul, Central-West Brazil. Black circles: previous records. The numbers corresponding to the records are indicated in Appendix Table A1.

objective of reducing the original data, facilitating their interpretation (Johnson and Wichern 1992). The components that accounted for most of the total variance were analyzed. A scatterplot of the best two component scores of the measurements was created to visualize the differences between *E. perotis* and other species of the genus. PCA test was computed with Past v. 3.2 (Hammer et al. 2001).

The specimens were deposited in the Zoological Reference Collection of the Federal University of Mato Grosso do Sul (ZUFMS). Fieldwork was authorized by the Brazilian Institute of Environment (ICMBio license number 56804-1) and by the Committee of Ethics for the Use of Animals of the Dom Bosco Catholic University (certification number 006/2017).

Results

New record. BRAZIL • 2 ♂, 2 ♀; Mato Grosso do Sul, Campo Grande, Florestinha Environmental Education Center; 20°24'10.90"S, 054°33'42.45"W; 5 Dec. 2017; Jaire Marinho Torres and Priscila Ikeda leg.; ZUFMS-CHI 02496-02499.

Identification. Compared to the measurements available for *Eumops perotis*, our specimens showed FA, CIL, BCB, CM, and MAL similar to that described for the species in other biomes of Brazil (Feijó et al. 2010; Suckow et al. 2010; Gregorin et al. 2016; Table 1). The morphological traits of our specimens fit to that of *E. perotis* descriptions (Anderson 1972; Eger 1977; Best et al. 1996; Bernardi et al. 2009; Gregorin et al. 2016; López-Baucells et al. 2017; Sartore et al. 2017). The specimens have a large, broad, and square tragus, and a broad and semicircular antitragus. The skull is long and flattened, with a reduced sagittal crest, and an elongated and deep basisphenoid pits. In all the specimens, the upper incisors are fused at the base,

and the third upper molar has the third commissure one-quarter the size of the second. A collected specimen and its skull are shown in Figure 2.

In the PCA the first two components explained, respectively, 89.4%, and 9.2% of external and cranial measurements variation, 98.6% of the total variation. In addition, the measurements of *E. perotis* individuals were well separated from the other species in the scatterplot (Fig. 3).

Discussion

Eumops perotis is the largest species of the genus and resembles mainly *E. trumbulli*, being differentiated by the size and length of the third commissure of the third molar (Sartore et al. 2017). Additionally, *E. trumbulli* is endemic to the Amazon basin (Sartore et al. 2017) and it is not recorded from the state of Mato Grosso do Sul (Fischer et al. 2015).

Although *E. perotis* is typically sheltered in rocky cliffs (Best et al. 1996), previous studies showed that individuals of this species are commonly found in urban areas sheltering in house linings (Barquez and Díaz 2001), as we observed here. *Eumops perotis* has been found in urban and peri-urban areas of at least five states (Amazonas, Goiás, Minas Gerais, Paraná, São Paulo) and the Federal District (Pacheco et al. 2010; Nunes et al. 2017).

Information on the distribution of *E. perotis* in Brazil has improved mainly due to records of the species since the 2000s. However, records of *E. perotis* are still scarce, especially in the Cerrado biome, which is the second largest biome in the Brazil (Fig. 1). The first records of *E. perotis* in the Cerrado were obtained from the states of Maranhão and Minas Gerais in the 1970s (Eger 1977), with additional records only in 2000s, from

Table 1. Measurements of *Eumops perotis* specimens from Campo Grande, in the Cerrado of Mato Grosso do Sul, Central-West Brazil (present study) and from previous localities. The minimum and maximum values for the measurements are shown in millimeters. Abbreviations: BCB, braincase breadth; C–M, length of upper canine–last molar; c–m, length of lower canine–last molar; CIL, condyle–incisive length; FA, forearm length; GLS, greatest length of skull; M–M, upper molar breadth; MAL, mandible length; N: number of specimens; PAL, palatal length; POB, post-orbital breadth; ZIB, zygomatic breadth.

Measure	Present study N = 4	Atlantic Forest – Maringá (PR) (Suckow et al. 2010) N = 2	Atlantic Forest – Três Barras (PR) (Suckow et al. 2010) N = 6	Caatinga – Ararauna (PB) (Feijó et al. 2010) N = 2	Pooled specimens of Brazil and Bolivia (Gregorin et al. 2016) N = 12	South America (Eger, 1977)*
FA	80.3–82.9	73.8–80.9	78.3–81.3	78.0–80.0	–	78.5–80.2
GLS	31.80–32.00	33.2†	–	31.1†	30.85–34.00	32.5–33.6
CIL	31.10–31.70	32.2†	–	–	30.07–32.68	31.0–32.1
PAL	12.20–12.90	–	–	13.7†	10.93–19.37	
ZIB	19.10–19.50	18.9–19.6	18.1–18.7	17.7–18.9	17.69–19.36	18.4–19.0
POB	5.70–6.00	5.5–5.9	5.5–5.8	5.4–5.7	5.22–5.89	5.3–5.5
BCB	13.10–13.40	–	–	14.6†	12.56–15.45	
C–M	12.90–13.30	12.7–3.2	–	12.7†	12.50–13.44	
M–M	13.10–13.50	12.5–13.4	12.9–13.3	13.0–13.3	12.54–13.40	
MAL	23.20–24.20	–	–	–	23.33–25.72	
c–m	14.60–14.70	–	–	13.6–13.7	13.61–14.56	12.8–13.1

†Represents the measurements of one individual.

*Number (N) of evaluated bats not included since for each measure authors used different number of animals.



Figure 2. *Eumops perotis* specimen from Campo Grande, in the Cerrado of Mato Grosso do Sul, Central-West Brazil. **A.** Adult male (ZUFMS-CHI 02498). **B.** Dorsal, ventral, and lateral views of the skull and mandible (views of the part of the skull ZUFMS-CHI 02498). Scale bar: 10 mm.

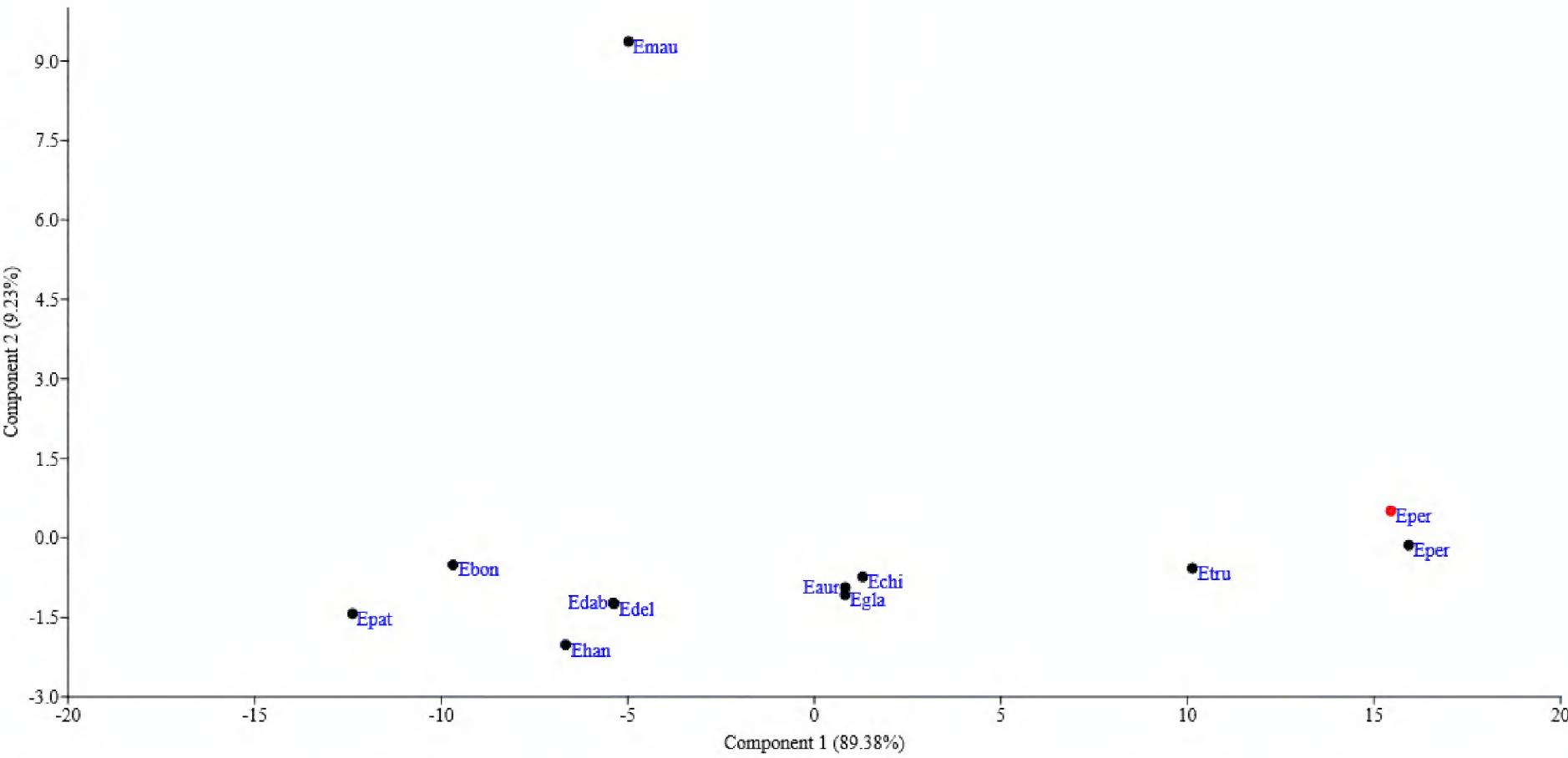


Figure 3. Scatterplot representation of the first two components obtained in the PCA of external and cranial measurement variation of species of *Eumops*. Red circle: *Eumops perotis* (current records). Black circles: *Eumops* species that occur in Brazil. Eaur: *Eumops auripendulus*; Ebon: *Eumops bonariensis*; Echi: *Eumops chimaera*; Edab: *Eumops dabbenei*; Edel: *Eumops delticus*; Egl: *Eumops glaucinus*; Ehan: *Eumops hansae*; Emau: *Eumops maurus*; Epat: *Eumops patagonicus*; Eper: *Eumops perotis*; Etru: *Eumops trumbulli*.

Minas Gerais (Stutz et al. 2004), São Paulo (Uieda and Chaves 2005), Distrito Federal (Pacheco et al. 2010), and Goiás (Nunes et al. 2017). Most of these records were close to the limit with the Atlantic Forest (Eger 1977; Stutz et al. 2004; Uieda and Chaves 2005). We clarify that the distribution of *E. perotis* shown in Figure 1 does not include its occurrence in the Federal District, as indicated by Pacheco et al. (2010), and Goiás, as indicated by Nunes et al. (2017), because these authors did not present the geographical coordinates of the species records. The few records of *E. perotis* from Cerrado may be the result of insufficient inventories in this biome, as studies are not well distributed in its area (Shapiro and Bordignon 2014). In addition, molossids are difficult to be captured with ground-level mist nets due to their high flights (Taylor and Tuttle 2019).

The current list of bat species from Mato Grosso do Sul (Fischer et al. 2015) reported *E. perotis* only in the Pantanal biome, based on one voucher specimen deposited in the Zoological Reference Collection of the Federal University of Mato Grosso do Sul (ZUFMS 0045). Therefore, our record expands the occurrence of *E. perotis* in the Cerrado portion of Mato Grosso do Sul, broadening its distribution in this biome, and contributing to fill gaps in the known distribution of the species.

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Authors' Contributions

JMT and PI conducted the survey. JMT identified the specimens. JMT, GEOP, MOB, FMS, and CEO wrote and revised the text.

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Appendix

Table A1. Locality records of *Eumops perotis* in Brazil. The asterisk indicates the new record from Campo Grande (this study), in the Cerrado of Mato Grosso do Sul state, Central-West Brazil.

Record no.	Municipality or locality	State	Latitude	Longitude	References
1	Paraná do Manhãna	AM	01°50'00.00"S	067°00'00.00"W	Suckow et al. 2010
2	Santa Isabel do Rio Negro	AM	00°24'51.04"S	065°00'52.96"W	Moratelli et al. 2010
3	Barcelos	AM	00°58'26.35"S	062°55'32.10" W	Moratelli et al. 2010
4	Rodovia AM-10 (Manaus - Itacoatiara)	AM	02°57'00.00"S	059°15'00.00" W	Piccinini 1974
5	Belém	PA	01°28'00.00"S	048°26'00.00" W	Piccinini 1974
6	Barro do Corda	MA	05°30'00.00"S	045°05'00.00" W	Eger 1977
7	Araruna	PB	06°27'32.39"S	035°40'44.67" W	Feijó et al. 2010
8	Sete Lagoas	PI	08°27'00.00"S	041°42'00.00" W	Eger 1977
9	Gruta dos Brejões	BA	11°00'24.63"S	041°26'09.68" W	Czaplewski and Cartelle 1998
10	Barão de Melgaço	MT	16°17'02.31"S	056°00'08.03" W	Escarlate-Tavares and Pêsoa 2005
11	Corumbá	MS	19°23'60.00"S	057°21'00.00" W	Fischer et al. 2015
12	Uberlândia	MG	18°55'00.00"S	048°16'60.00" W	Stutz et al. 2004
13	Água Comprida	MG	20°03'28.94"S	048°06'26.38" W	Gómez-Hernández et al. 2017
14	Lagoa Santa	MG	19°38'60.00"S	043°44'00.00" W	Eger 1977
15	Serra da Caraça	MG	20°04'60.00"S	043°29'00.00" W	Falcão et al. 2003
16	Mariana	MG	20°22'60.00"S	043°24'60.00" W	Eger 1977
17	Mirassol	SP	20°49'02.56"S	049°30'17.66" W	Marchesin et al. 2008
18	São José do Rio Preto	SP	20°48'45.76"S	049°22'35.48" W	Marchesin et al. 2008
19	Bady Bassitt	SP	20°54'58.96"S	049°26'55.83" W	Marchesin et al. 2008
20	Pindorama	SP	21°11'30.76"S	048°53'31.92" W	Breviglieri and Esbérard 2018
21	Ribeirão Preto	SP	21°10'13.44"S	047°48'37.17" W	Castilho et al. 2008
22	Botucatu	SP	22°52'56.08"S	048°26'51.60" W	Uieda and Chaves 2005
23	São Paulo	SP	23°27'60.00"S	046°37'60.00" W	Sodré et al. 2008
24	Campos dos Goytacazes	RJ	21°48'60.00"S	041°15'60.00" W	Eger 1977
25	Itaguaí	RJ	22°51'00.00"S	043°46'60.00" W	Eger 1977
26	Rio de Janeiro	RJ	22°52'60.00"S	043°16'60.00" W	Eger 1977
27	Londrina	PR	23°18'15.09"S	051°10'09.86" W	Suckow et al. 2010
28	Maringá	PR	23°25'15.60"S	051°55'59.00" W	Suckow et al. 2010
29	Três Barras do Paraná	PR	25°25'18.43"S	053°11'03.51" W	Suckow et al. 2010
30	Victor Graeff	RS	28°33'37.78"S	052°44'58.60" W	Pacheco and Freitas 2003
*	Campo Grande	MS	20°24'09.38"S	054°33'53.78" W	New record